Proposed Approach for Making SMA Services Transparent to MA Users

1 Overview

1.1 General

TDRS H, I, J will offer a new S-band Multiple Access (MA) capability known as SMA. SMA is backward compatible with the current MA capability with regard to the RF interface between the customer spacecraft and the TDRS, but is not backward compatible with regard to message formats. This paper outlines an approach for making SMA transparent to MA users.

1.2 Operations Concept

This approach is almost completely transparent to MA users. With no modification to any user system and with no change to the format or content of any external message, any MA user will be able to obtain equivalent SMA services. For specified customers, any valid schedule request for MA services will result in the scheduling of SMA services if the request applies to TDRS H, I, or J.

The general scenario is as follows:

a. Customer submits request for MA services.

b. If request applies exclusively to TDRS H, I, or J, the NCCDS substitutes SMA SSCs for the MA SSCs referenced by the request.

c. SMA services are scheduled.

d. Within USMs, SMA service formats are translated to MA service formats.

e. If the customer submits an MA service GCMR for an SMA service, the NCCDS accepts the GCMR and formats SMA OPM.

f. Upon receipt of SMA performance data, the NCCDS translates this to MA format.

1.2.1 Exceptions to Transparency

1.2.1.1 Users

With only one exception, this approach is completely transparent to MA users. The exception is as follows:

- If an MA schedule request refers to a TDRS set containing a mixture of old (i.e., TDRS A-G) and new (i.e., TDRS H-J) TDRSs, the NCCDS will limit its scheduling attempts to the old TDRSs in the set. This is the current behavior of NCC 98.

1.2.1.2 NCC Operators

When the NCCDS schedules SMA services for MA users, this will noticeable to the NCC operators in two ways:

- During verbal communications with the users, the users will refer to MA services while various NCCDS scheduling displays present SMA service information to the NCC operators.

- ODM displays will present SMA data in MA format. This will involve the deletion of some parameters.

1.3 NCCDS Impacts

The following areas of the NCCDS are affected:

- Database

- Schedule message input

- Schedule message output

- GCMR processing

- Performance Data

2 Database

2.1 General

The following three changes would be needed in the NCCDS database:

a. Addition of new customer parameter to indicate that the NCCDS is to make SMA/MA transparent.

b. Addition of new parameter to MAF SSC format to allow linkage to an SMAF SSC.

c. Addition of new parameter to MAR SSC format to allow linkage to an SMAR SSC.

2.2 Relationship of MAF and SMAF SSCs

For an MAF user, an equivalent SMAF SSC will be an exact copy of the MAF SSC except for the SSC ID and service type parameters.

2.3 Relationship of MAR and SMAR SSCs

The MAR SSC format contains 30 parameters. The SMAR SSC format contains 42 parameters. For an MAR user, an equivalent SMAR SSC will copy all parameters from the MAR SSC except for the SSC ID and service type parameters. The remaining 12 parameters will be set as follows:

a. Service Configuration --- always Normal User

b. Data Coding, I channel --- always Code 1

c. Data Coding, Q channel --- always Code 1

d. DG2 Modulation --- not applicable, ASCII space

e. Maximum MDM Data Rate, I Channel --- zero for LI users; otherwise same as Maximum Data Rate, I Channel

f. Maximum MDM Data Rate, Q Channel --- zero for LI users; otherwise same as Maximum Data Rate, Q Channel

g. Maximum HDRM Data Rate, I Channel --- always zero

h. Maximum HDRM Data Rate, Q Channel --- always zero

i. SSA Combining --- not applicable, ASCII space

j. Polarization --- always LCP

k. Data Group --- always DG1

l. DG2 Type --- not applicable, ASCII space

<div align="center">NOTE</div>

In two instances, equivalent MAR and SMAR parameters have different names:

- "Configuration" and "DG1 Configuration"

- "Mode" and "DG1 Mode"

3 Schedule Message Input

The following logic would be added to schedule message input:

IF the following two conditions apply to a schedule request

 Request is for an SMA/MA transparent customer

 Request does not apply to TDRS A - G or to a TDRS set containing TDRS A - G

THEN for each referenced MA SSC

 IF MA SSC is linked to an SMA SSC

 THEN

  Replace MA SSC with SMA SSC

 ELSE

  Decline request

 ENDIF

ENDIF

4 Schedule Message Output

4.1 General

The following logic would be added to schedule message output:

    IF USM is for SMA/MA transparent customer

    THEN

        Reformat any SMAF service as MAF

        Reformat any SMAR service as MAR

    ENDIF

4.2 SMAF to MAF Translation

- The value of the "Service Support Subtype" parameter is changed from 5 to 0.

- The SSAF SSC ID is replaced with the original MAF SSC ID.

4.3 SMAR to MAR Translation

- The value of the "Service Support Subtype" parameter is changed from 5 to 0.

- The SSAR SSC ID is replaced with the original MAR SSC ID.

- Nineteen parameters that aren't applicable to MAR are deleted.

- The remaining parameters are reordered to match the MAR format.

5 GCMR Processing

5.1 Affected Messages

The following GCMRs are affected:

    a. User Reacquisition Request Message -- (Table 8-1)

    b. Forward Link Sweep Request Message -- (Table 8-2)

    c. Expanded User Frequency Uncertainty Request Message -- (Table 8-4)

    d. MA/SMA Forward Link Reconfiguration Request Message -- (Table 8-5)

    e. MA Return Link Reconfiguration Request Message -- (Table 8-8)

    f. Doppler Compensation Inhibit Request Message -- (Table 8-11)

5.2 Logic

5.2.1 General

For the above GCMRs, the following logic would be added:

>IF GCMR is for MA service but corresponding SMA service is scheduled
>
>THEN
>
>>Accept GCMR
>>
>>Format OPM with SMA link identification
>
>ENDIF

5.2.2 MAR Link Reconfiguration GCMR

Some additional logic may be needed to translate a User Service Reconfiguration GCMR for an MAR service to a User Service Reconfiguration OPM for SMAR. However, this should be minimal since:

- Only the parameters that are actually being reconfigured have to be translated. All other parameters will remain blank.

- The existing internal process for creating a User Service Reconfiguration OPM from a User Service Reconfiguration GCMR primarily depends on parameter names rather than on the position of parameters within the message formats.

6 Performance Data

6.1 General

Three types of messages are affected:

- OPMs

- Simulation ODMs

- SMAR ODMs

NOTE

>The formats and parameter values of SMAF and MAF ODMs are identical. No change is needed.

6.2 OPMs

The following messages are affected:

a. Return Channel Time Delay Measurement Message -- (Table 8-16)

b. Acquisition Failure Notification Message -- (Table 8-17)

c. Time Transfer Message -- (Table 8-18)

The following would be added to the output logic for the above messages:

> IF message is for an SMA service (i.e., the "Service Support Subtype" parameter value equals 5) for an SMA/MA transparent customer
>
> THEN
>
> > Set value of "Service Support Subtype" parameter to 0
>
> ENDIF

6.3 ODMs

6.3.1 General

The simulation and SMAR ODMs are reformatted as they are received and before they are stored. Thus, they will appear the same to the NCC operators as they do to the customers.

6.3.2 Simulation ODMs

The following formats are affected:

a.   Simulation Forward Service Data Packet -- (Table 8-36)

b.   Simulation Return Service Data Packet -- (Table 8-37)

Following receipt of the above ODM data, the following logic would be added prior to storing the messages:

> IF message is for an SMA service (i.e., the "Service Support Subtype" parameter value equals 5) for an SMA/MA transparent customer
>
> THEN
>
> > Set value of "Service Support Subtype" parameter to 0
> >
> > Store
>
> ENDIF

6.3.3 SMAR ODMs

6.3.3.1 General

In terms of NCCDS output, data that would normally be output as SMAR data in the following formats:

a.   SA/SMAR Service Type Header Data Packet -- (Table 8-20)

b.   SSA/SMA DG1 Return Service Data Packet -- (Table 8-23)

c.   SSA/SMA Return Service Data Quality Monitoring Packet -- (Table 8-26)

would be reformatted so that it would be output in the following formats:

a.   MA/SMAF Service Type Header Data Packet Format -- (Table 8-31)

b. MA Return Service Data Packet Format -- (Table 8-33)

c. MA Return Service Data Quality Monitoring Packet Format -- (Table 8-34)

Following receipt of SMAR ODM data, the following logic would be added prior to storing the messages:

IF data is for an SMA/MA transparent customer

THEN

Reformat and store as MAR data

ENDIF

6.3.3.2 SA/SMAR Service Type Header Data Packet

For SMAR, each SSA/SMA DG1 return service data packet (refer to 9.5.3.5 of the WSC ICD) will be accompanied by an SA/SMAR service type header data packet (refer to 9.5.1 of the WSC ICD). In order to store the SSA/SMA DG1 return service data packet as an MA return service data packet, the SA/SMAR service type header data packet will be copied and stored as an MA/SMAF service type header data packet (refer to 9.5.4 of the WSC ICD). In terms of the incoming formats, these two header data packets are identical except for the value of the message type parameter and for the presence of eight spare bytes in the MA/SMAF service type header data packet.

6.3.3.3 SSA/SMA DG1 Return Service Data Packet

For SMAR, the SSA/SMA DG1 return service data packet (refer to 9.5.3.5 of the WSC ICD) must be stored as if it were an MA return service data packet (refer to 9.5.5.2 of the WSC ICD). Exclusive of SA/MA/SMA ODM Subheader #8 data and spare parameters, the MA return service data packet contains 27 parameters. Although they are in a different order, these 27 parameters are a subset of the parameters in the SSA/SMA DG1 return service data packet. All other parameters will be discarded. The remaining parameters will be reordered and stored as if they had been received as an MA return service data packet.

6.3.3.4 SSA/SMA Return Service Data Quality Monitoring Packet

For SMAR, each SSA/SMA DG1 return service data packet (refer to 9.5.3.5 of the WSC ICD) includes two copies of SA/MA/SMA ODM Subheader #8 (refer to 9.5.2.8 of the WSC ICD). In order to store the SSA/SMA DG1 return service data packet as an MA return service data packet, the two copies of SA/MA/SMA ODM Subheader #8 must be stored as if they had been received as part of an MA return service data packet (refer to 9.5.5.2 of the WSC ICD).